

Key Concepts

- You can solve linear systems using any of the three methods: graphing, substitution, or elimination.
- Look at the equations carefully to see if there is an advantage to solving using a particular method.

Communicate Your Understanding

- C1** In what situations would solving by graphing be your preferred choice? Give an example.
- C2** In what situations would solving by substitution be your preferred choice? Give an example.
- C3** In what situations would solving by elimination be your preferred choice? Give an example.
- C4** Write a linear system that can be solved by any of the three methods.

■ Practise

For help with questions 1 to 6, see Example 1.

1. Leanne works at a greenhouse. She needs to plant a total of 32 bulbs. Two types of bulbs are available. She is asked to plant three times as many crocus bulbs as tulip bulbs. How many of each should she plant?
2. James looks in his TV cabinet and finds some old Beta and VHS tapes. He has 17 tapes in all. He finds that he has three more Beta tapes than VHS tapes. How many of each type does he have?
3. The girls' soccer team held a fundraising car wash. They charged \$5 for each car and \$8 for each van. They washed 44 cars and vans and collected \$262. How many of each type of vehicle did they wash?
4. Rehman invests his summer earnings of \$3050. He invests part of the money at 8%/year, and the rest at 7.5%/year. After 1 year, these investments earn \$242 in simple interest. How much did he invest at each rate?
5. Why might it be more appropriate to solve questions 1 and 2 by graphing than questions 3 and 4?
6. Consider the linear system
$$\begin{aligned}3x - y &= 8 \\4x - y &= -15\end{aligned}$$
 - a) Which method would you choose to solve the linear system and why? Solve using the method you chose.
 - b) Now solve using one of the other methods available to you.

Connect and Apply

For help with questions 7 and 8, see Example 2.

7. Tyler rows 10 km downstream in 2 h. On the return trip, it takes him 4 h to travel 8 km. Determine his average rowing speed and the speed of the current.
8. With a tailwind, a plane flew the 3000 km from Calgary to Montréal in 5 h. The return flight, against the wind, took 6 h. Find the wind speed and the speed of the plane.

For help with questions 9 and 10, see Example 3.

9. Milk and cream contain different percents of butterfat. How much 3% milk needs to be mixed with how much 15% cream to give 20 L of 6% cream?
10. Amy needs to make 10 L of 42% sulphuric acid solution. In the supply room, she finds bottles of 30% sulphuric acid solution and 60% sulphuric acid solution. What volume of each solution should she mix in order to make the 42% solution?
11. To join Karate Klub, David must pay a monthly fee of \$25 and an initial fee of \$200. If he chooses Kool Karate, he must pay an initial fee of only \$100 but \$35/month.
 - a) After how many months is the cost the same at either karate club?
 - b) If David plans to try karate for 6 months, which club should he join?
 - c) If David decides to do karate for a year, which club should he join?
12. For a school band trip, Marcia decides to order T-shirts for all of the participants. It will cost \$4 per shirt for the medium size, and \$5 per shirt for the large size. Marcia orders a total of 70 T-shirts and spends \$320. How many are medium shirts?
13. One type of granola has 30% nuts, by mass. A second type of granola has 15% nuts. What mass of each type needs to be mixed to make 600 g of granola that will have 21% nuts?
14. A metal alloy is 25% copper. Another metal alloy is 50% copper. How much of each should be used to make 500 g of an alloy that is 45% copper?
15. Some students at L.C.V.I. held a bake sale recently to raise money for a field trip. They charged \$7 for fruit pies and \$10 for meat pies. They sold a total of 52 pies and earned \$424. How many of each type of pie did they sell?
16. A class trip is being planned. For one option, each student will pay \$630. This includes two meals a day and accommodation for the 9-day trip. The other option offers three meals a day and accommodation for the 9 days. This second option costs \$720. What is the cost per meal? What is the cost per day for accommodation?

Extend

17. Ian flew his airplane at best cruise speed for 2 h, then at economy cruise speed for 3 h, covering a total of 850 km. On the following day, he flew at best cruise speed for 3 h and at economy cruise speed for 2 h, covering a total of 900 km. Find the best cruise speed and the economy cruise speed for Ian's airplane.
18. A train leaves Toronto for Montréal at the same time as another train leaves Montréal for Toronto. The cities are 500 km apart. The trains pass each other 2 h later. The train from Montréal is travelling 50 km/h faster than the one from Toronto. At what distance away from Toronto do the trains pass each other?
19. Sam is a jewellery artist. She needs to mix metals to make her products. Pure gold is 24-karat and is very soft. It is usually mixed with other metals such as silver to make it harder. Sam has some 18-karat gold ($\frac{18}{24}$ pure gold) and some 9-karat gold ($\frac{9}{24}$ pure gold). What mass of each type of gold should she use to make 600 g of 15-karat gold?
20. **Math Contest** A chemist has one 30-L bottle of 15% hydrochloric acid and one 30-L bottle of 90% hydrochloric acid. She mixes 20 L of 60% hydrochloric acid and then pours 5 L of that solution back into the bottle containing the 90% hydrochloric acid. How strong is the acid in that bottle now?

Connect and Apply

In each problem, write one or two sentences to describe your strategy. Then, carry out your strategy and justify your solution. Reflect and decide if your strategy was an appropriate one.

5. Paul claims that you only need seven coins to be able to make any amount of money up to 50¢. Show that Paul is correct.

6. Copy the numbers in the order shown. Replace each ■ with some of the symbols +, −, ×, ÷, (), and = to make true statements.

a) $5 \blacksquare 2 \blacksquare 8 \blacksquare 3 \blacksquare 15$

b) $25 \blacksquare 5 \blacksquare 11 \blacksquare 25 \blacksquare 9$

c) $\frac{1}{2} \blacksquare \frac{1}{3} \blacksquare \frac{11}{12} \blacksquare \frac{1}{12}$

d) $\frac{2}{3} \blacksquare \frac{1}{8} \blacksquare \left(-\frac{1}{12}\right)$

mean

- the sum of the values in a set of data, divided by the number of values in the set

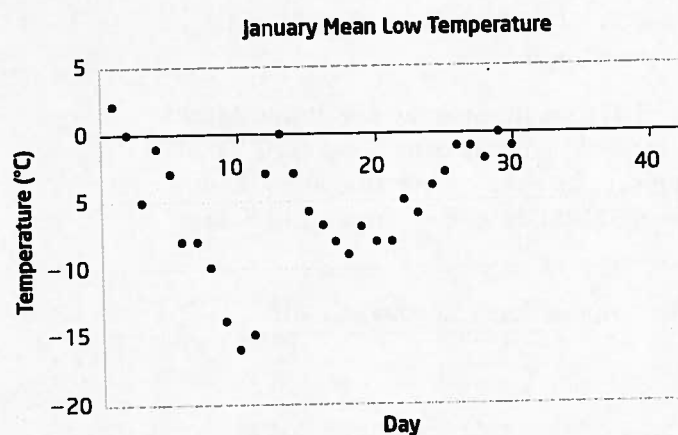


counter-example

- an example that proves that a conjecture is false



7. The **mean** low temperature between January 1 and January 30 was -5°C .



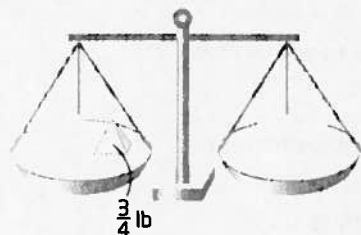
- What would the temperature need to be on January 31 to lower the mean temperature to -6°C ?
- What would the temperature need to be on January 31 to raise the mean temperature to -4.5°C ?

8. Give a **counter-example** to prove each statement false.

- All prime numbers are odd.
- The sum of any two integers is always negative.
- All fractions are less than 1.
- All quadrilaterals are rectangles.

9. In the game of chess, a knight can move two spaces forward or backward and one space left or right, or two spaces left or right and one space forward or backward. Copy the small board shown. Can a knight eventually land on any square on the board?

10. Although most masses are measured in kilograms or grams in Canada, cheese is often bought by the pound. Three quarters of a pound and three quarters of a block of cheese balance with an entire block of cheese. What is the mass of the block of cheese, in pounds?



11. The integer -5 can be expressed as a difference of squares.

$$\begin{aligned} 2^2 - 3^2 \\ = 4 - 9 \\ = -5 \end{aligned}$$

How many integers between -1 and -10 can be expressed as a difference of squares of whole numbers?

12. Sam went on four rides a total of nine times at the fair. Roller Magic costs \$3.25, Death Drop costs \$3.75, The Amazing Loop costs \$4.00, and Fire Pit costs \$4.50. Sam says he went on one ride more than three times. He spent a total of \$33.00. How many times did Sam go on each ride?

13. How many floor tiles are there on the floors in your school?

Extend

14. Each three by three square, each row, and each column must contain each of the numerals 1 through 9 only once. Copy and complete this Sudoku puzzle.

		1	6	9		8		2
		7	5					
	9		2	4				7
	2	5						
	1		8	5	9			2
						9	5	
	7			1	5			9
					3	2		
3		9		2	6	4		

15. What is the mass of a school bus with 45 student passengers?
16. For the sequence 1, -2 , -2 , 3, 3, 3, -4 , -4 , -4 , -4 , 5, 5, 5, 5, 5, ... ,
- what is the 50th term?
 - what is the 100th term?
 - what is the sum of the first 50 terms?
 - what is the sum of the first 100 terms?